REMARKS

The Office Action dated October 28, 2008 has been reviewed, and reconsideration of the application and allowance thereof are requested based on the following remarks.

Claims 1-6 and 8-12 stand rejected under 35 U.S.C. §103(a), as being obvious over, Mizuta et al., JP Patent No. JP 2003-304316A in view of Tseng et al., US Patent No. 6 587 333 B2. Applicant respectfully traverses this ground of rejection and urges that the presently claimed invention is patentably distinguishable over the prior arts cited by the Examiner.

The instant invention as defined in Claim 1 is directed to a two-shaft hinge having a two-shaft structure, comprising:

> a rotation shaft;
>
> an opening/closing shaft;
>
> a rotation torque unit in which a plurality of rotation torque generating portions are provided on the rotation shaft, the rotation torque generating portions being assembled by putting a first coil spring around an outer periphery of the rotation shaft having a penetrating hole and by abutting a first fixing cam and a first rotating cam on both ends of the first coil spring; and
>
> an opening/closing torque unit in which a plurality of opening/closing torque generating portions are provided on the opening/closing shaft, the opening/closing torque generating portions being assembled by putting a second coil spring around the opening/closing shaft and by abutting a second fixing cam and a second rotating cam on both ends of the second coil spring,

wherein an axial direction of the rotation shaft and an axial direction of the opening/closing shaft are assembled to a hinge housing to be perpendicular to each other, the hinge housing having a first through-hole through which the rotation shaft pierces on one side of the rotation torque unit and a

second through-hole through which a harness wiring can pass on the other side of the rotation torque unit, the torque units generate a sliding torque and a click torque at rotation, and an opening/closing operation function on the rotation shaft and the opening/closing shaft, and the opening/closing torque unit is assembled to either a right side or a left side of the rotation torque unit.

Mizuta teaches a two-shaft hinge mechanism used for a foldable and portable mobile communication terminal. Specifically, Mizuta discloses the two-shaft hinge mechanism, comprising: a first hinge unit 320 that allows an upper-side body unit to rotate with respect to a lower-side body unit up to an open state defining a predetermined talking position; and a second hinge unit 310 that allows the first hinge unit 320 to rotate in a direction different from the rotational direction of the first hinge unit, wherein the first and the second hinge units are coupled so that the rotational center axes orthogonally intersect each other. Also, Mizuta teaches a fixed shaft 312 located in an outer case 311 and fixed by a base bracket 301, the first rotating shaft (opening/closing rotating shaft) 321. The first hinge unit 310 includes a fixed cam 323, a rotating cam 324, and a coil spring 325. The second hinge unit 310 also includes rotating cams 314a and 314b, fixed cams 313a and 313b, and a coil spring 315. Further, Mizuta discloses that portions serve as a torque unit generating a rotational torque, and that other portions serve as a torque unit for generating an opening/closing torque.

However, Mizuta does not teach the structure of the rotation shaft having a penetrating hole of the present invention, which allows a harness wiring.

In addition, the fixed shaft 312 does not perpendicularly penetrate through the center axis of the opening/closing shaft. The Examiner responds in paragraph 23 of Response to argument that it is clear from Figure 2 (Figure 5 in U.S. Patent No. 7 158 816) that the axes of the opening/closing shaft and rotation shaft intersect perpendicularly. However,

the Examiner's argument is wrong because in Figure 2, the fixed shaft 312 does not penetrate the first rotation shaft 321, as shown in attached Exhibit Figure A4. The first rotation shaft 321 extends horizontally from right to left, while the fixed shaft 312 is located below the first rotation shaft 321. With such a structure, it is not possible to have harness wiring going through along the center axis of the fixed shaft 312, passing through the center axis of the first rotation shaft 321 perpendicularly, and eventually going through to the top of the hinge. The first rotation shaft 321 is in the way, and prevents the harness wiring from passing from the bottom of the fixed shaft to the top of the hinge at the center.

In addition, Mizuta does not teach that the opening/closing torque unit of the present invention is assembled to either a right side or a left side of the rotation torque unit. Also, Mizuta does not show that the hole through which the harness wiring can pass is provided on the other side of the rotation torque unit.

Figure 6 of Mizuta (Figure 9 in U.S. Patent No. 7 158 816) confirms that harness wiring cannot pass from the bottom to the top of the hinge. The perspective view shows the states of the main section of the two-shaft hinge mechanism 300. In the cross-section view, the first rotation shaft 321 is clearly provided above the fixed shaft 312 preventing continuous through-wiring from bottom to top. The opening/closing control pin 326 shown in Figure 6 also prevents the through-wiring. In addition, on top of the fixed shaft 312, the projection 312b is provided to contact with the first rotation shaft 321 so that the range of opening/closing movement can be controlled. The projection 312b also prevents the through-hole from being inside the fixed shaft 312.

The present invention realizes the harness wiring, as shown in Exhibit Figure A2, from the bottom of the rotation shaft through the penetrating hole 11-1 provided inside of the rotation shaft to the top of the hinge housing, and then to

the second through-hole 9-1 in the hinge housing, which is provided on the other side of the rotation shaft from the opening/closing torque unit.

The wiring of Mizuta's hinge cannot be realized by a harness wiring because of its structure as discussed above. Mizuta, instead, uses the flexible printed circuits (FPC), as described in column 10, lines 48-60 of '816 reference. Exhibit Figure A1 shows an example of the electrical connection with the FPC. In Exhibit Figure A1, the FPC wiring is provided around the rotation shaft and the opening/closing shaft in the sponge roll fashion. Also, Exhibit Figures A3a and A3b compare the harness wiring with the FPC wiring. The FPC is then covered by outer covers. Practically, there is no method other than to use the FPC rolling around the shafts for Mizuta's hinge, because Mizuta's hinge cannot make the harness wiring passing inside of the rotation shaft penetrating all the way from the bottom of the rotation shaft to the top of the hinge. Thus, Mizuta's hinge should use the FPC to roll around the shafts, which is not structurally robust, and requires outer cover to protect it as shown in Exhibit Figure A1. This, in turn, causes increase in number of components for the hinge.

The present invention solves such problems of Mizuta. The present invention cannot be achieved simply by combining Mizuta's hinge and Tseng's hollow shaft, because a continuous through-hole connecting the bottom of the rotation shaft and the top of the hinge that accommodates the continuous wiring from the bottom to the top cannot be realized with Mizuta's hinge.

The Examiner states that Mizuta discloses the first through-hole on the bottom of the coupling bracket 303 as shown in Figure 3 of Mizuta, and the second through-hole on the side of the coupling bracket 303. However, the coupling bracket 303 is not the hinge housing, and does not function the same way as the housing unit of the present invention. The first rotating shaft 321 of Mizuta, as shown in column 8,

lines 24-35 of '816 reference, pierces both sides of the second through-hole in the coupling bracket 303, and the first hinge unit 320 fixes one end side of the outer case 322 to one side of the coupling bracket 303 via the rotating shaft 321. Thus, the first hinge unit (torque unit) of Mizuta is assembled with normal force provided by the side of the coupling bracket 303, and at the same time, the first rotating shaft 321 should pierce the coupling bracket 303 through to the other side of the coupling bracket 303.

On the contrary, the two shaft hinge of the present invention includes only one opening/closing torque unit fixed on one side of the hinge housing, and the opening/closing shaft does not pierce through the hinge housing. In addition, the opening/closing torque unit of the present invention does not need normal force from the hinge housing in order to operate. Further, it is not guaranteed that the coupling bracket 303 of Mizuta has the same structural strength as that of the hinge housing of the present invention. Unlike the hinge housing of the present invention, the coupling bracket 303 is evidently weak against bending forces.

The Examiner also admits that Mizuta does not teach the structure of the rotation shaft having the penetrating hole, and cites Tseng so as to allegedly cure this deficiency.

Tseng teaches a tilt/swivel hinge mechanism for large devices such as computers and electronic books. Tseng also teaches a hinge that includes a rotation shaft having a penetrating hole.

However, Tseng's shaft having a through-hole, or hollow shaft, is structurally different from the present invention. Tseng's shaft uses an ellipsoidal cylinder for the torque and click generation, which is the swivel mechanism using a torsion provided by the friction between the projection of the elastic member and the surface of the swivel base.

On the contrary, the two-shaft hinge of the present invention has a hinge housing to which the rotation torque unit and the opening/closing torque unit are assembled, which

enables the wiring penetrating through the rotation shaft from top to bottom. Thus, the combining the mounting base 33 of Tseng, which includes the second cylinder 333 having the cable hole 332 formed at the center of the second cylinder 333, with the two-shaft hinge of Mizuta cannot show the two-shaft hinge of the present invention.

Moreover, the structure and the size of the components of Tseng's hinge are highly different from those of the present invention. The tilt/swivel hinge mechanism of Tseng is used for large devices, whereas the two-shaft hinge of the present invention is used for a folding/rotating mechanism part on small electronic devices. The present invention provides two-shaft hinge components which enable the harness wiring by using a hollow rotation shaft, and thus improves durability and provides a reduction in size and weight of the devices. On the other hand, the tilt/swivel hinge mechanism of Tseng uses torsion by the friction between the projection of the elastic member and the surface of the swivel base, and thus the size of Tseng's hinge and torque required to activate rotation or opening/closing action is different from the size of the present invention. Therefore, the technical field of Tseng's invention is totally different from that of the present invention. There would be no suggestion or motivation to combine the hinge mechanism of Tseng with Mizuta's two-shaft hinge, and it is not guaranteed that the Tseng's mounting base 33 with the cylinder 333 having a cable hole 332 would work properly with the Mizuta's hinge. Moreover, attempting to incorporate Tseng's mounting base into Mizuta's hinge would necessarily involve a complete re-structuring of Mizuta's disclosed arrangement.

Accordingly, Claim 1 is believed to be patentably distinguishable over Mizuta and Tseng, alone or in combination with one another.

Claim 2 is directed to the same two-shaft as Claim 1, except that a pair of rotation torque generating portions, rather than a plurality of rotation torque generating portion,

are provided on the rotation shaft, and therefore, is believed to be allowable over Mizuta and Tseng for the same reasons as presented above relative to Claims 1.

Claims 3-6 and 8-12 depend upon what is believed to be an allowable Claim 1, are believed allowable therewith, and include additional features which further distinguish over Mizuta and Tseng. For example, Claim 3 further discloses that the rotation torque unit is assembled on the rotation shaft, and that a plurality of the rotation torque generating portions are assembled on the rotation torque unit and have torque generating operations to generate the sliding torque and the click torque by abutting the first fixing cam and the first rotating cam, the torque generating operations being different and independent to one another by combining the first fixing cam and the first rotation cam having different positions of a concave groove and a convex protrusion of the first fixing cam and the first rotation cam or by combining different numbers of the cams. Similarly, Claim 4 discloses that the opening/closing torque unit is assembled on the opening/closing shaft, and a plurality of the opening/closing torque generating portions are assembled on the opening/closing torque unit and have torque generating operations to generate the sliding torque and the click torque by abutting the second fixing cam and the second rotating cam, the torque generating operations being different and independent to one another by combining the second fixing cam and the second rotation cam having different positions of a concave groove and a convex protrusion of the second fixing cam and the second rotation cam or by combining different numbers of the cams. Mizuta and Tseng do not teach such torque generating operations, and the assembly of the torque units or a plurality of the torque generating portions. Also, Mizuta and Tseng do not disclose combining the fixing cam and the rotation cam having different positions of a concave groove and a convex protrusion of the fixing cam and the rotation cam or combining different numbers of the cams.

Claim 5 discloses that a cross-section of a part of the rotation shaft and the opening/closing shaft is other than a circle, or is formed to be a quadrangle or a shape having a major axis and a minor axis, allowing the first and the second fixing cams for rotation and opening/closing, which are used respectively in the rotation torque generating portions and the opening/closing torque generating portions, to move respectively in the axial direction of the rotation shaft and the axial direction of the opening/closing shaft, but inhibiting the first and the second fixing cams from rotating with respect to the rotation shaft. Mizuta discloses that the fixed shaft 312 has substantially a solid-cylindrical shape or hollow-cylindrical shape, and is fixed to the base bracket 301, but Mizuta does not disclose a cross-section of a part of the rotation shaft and the opening/closing shaft is other than a circle, or is formed to be a quadrangle or a shape having a major axis and a minor axis.

Claim 6 discloses a stopper mechanism to restrict a rotation angle and an opening/closing angle of the rotation shaft and the opening/closing shaft so that rotation ranges of the rotation shaft and the opening/closing shaft are restricted. Mizuta discloses a movable rotation stopper 317 and a rotation stopper in order to limit the rotational angle of the upper-side body unit 20, rather than restrict the angles of the rotation shaft and the opening/closing shaft.

Claim 8 discloses that the rotation shaft having the penetrating hole in which a through-hole is provided at a center of the rotation shaft, in order to enable the harness wiring. As discussed above for Claim 1, Mizuta and Tseng do not disclose even the rotation shaft having the penetrating hole.

Claim 9 discloses that a case for the rotation shaft and a case for the opening/closing shaft in each of which an outer periphery has a groove or a deformed cross-section other than a circle are fitted with or fixed to the first and the second rotating cams in each of which an outer periphery has a

protrusion or a deformed cross-section. Although Mizuta teaches outer cases 311, 322, Mizuta does not disclose that the outer periphery of the cases have the groove or the deformed cross-section other than a circle.

Claim 10 discloses that the first rotating cam used in the rotation torque generating portions is configured to be a bottom portion to which the rotation torque unit is fitted and attached in the hinge housing. Both Mizuta and Tseng do not teach such a feature.

Claim 11 discloses that the rotation torque unit and the opening/closing torque unit are assembled as an independent unit, the torque units being fitted and attached to or screwed into the hinge housing in which a means for fitting or screwing to fix is provided in advance. Both Mizuta and Tseng do not disclose such a feature.

Claim 12 discloses a fixing base component adhered to the rotation shaft for mounting and fixing the two-shaft hinge to a device chassis, wherein the two-shaft hinge is fixed by the base component. Mizuta shows the fixed shaft 312 fixed by the base bracket 301, but does not show the fixing component.

Claim 7 stands rejected under 35 U.S.C. §103(a), as being obvious over, Mizuta et al., JP Patent No. JP 2003-304316A in view of Tseng et al., US Patent No. 6 587 333 B2 and in further view of Katoh, US Patent No. 5 867 872. Applicant respectfully traverses this ground of rejection and urges that the presently claimed invention is patentably distinguishable over the prior arts cited by the Examiner. Claim 7 teaches a disc spring, a waved plate spring, or a thin plate spring in place of the first and the second coil springs which generate an abutting force in the torque generating portions. Katoh teaches disk springs 17 in mutually facing positions so as to press the rotating cam member 16 against the stationary cam member 12 side, but Katoh does not disclose the waved plate spring and the thin plate spring.

Accordingly, Claim 7 is believed to be patentably distinguishable over Mizuta, Tseng, and Katoh, alone or in combination with one another.

For the above reasons allowance of Claims is respectfully requested. Further and favorable reconsideration is respectfully requested.

Respectfully submitted,

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Encl: Figs. A1-A4 (four sheets)
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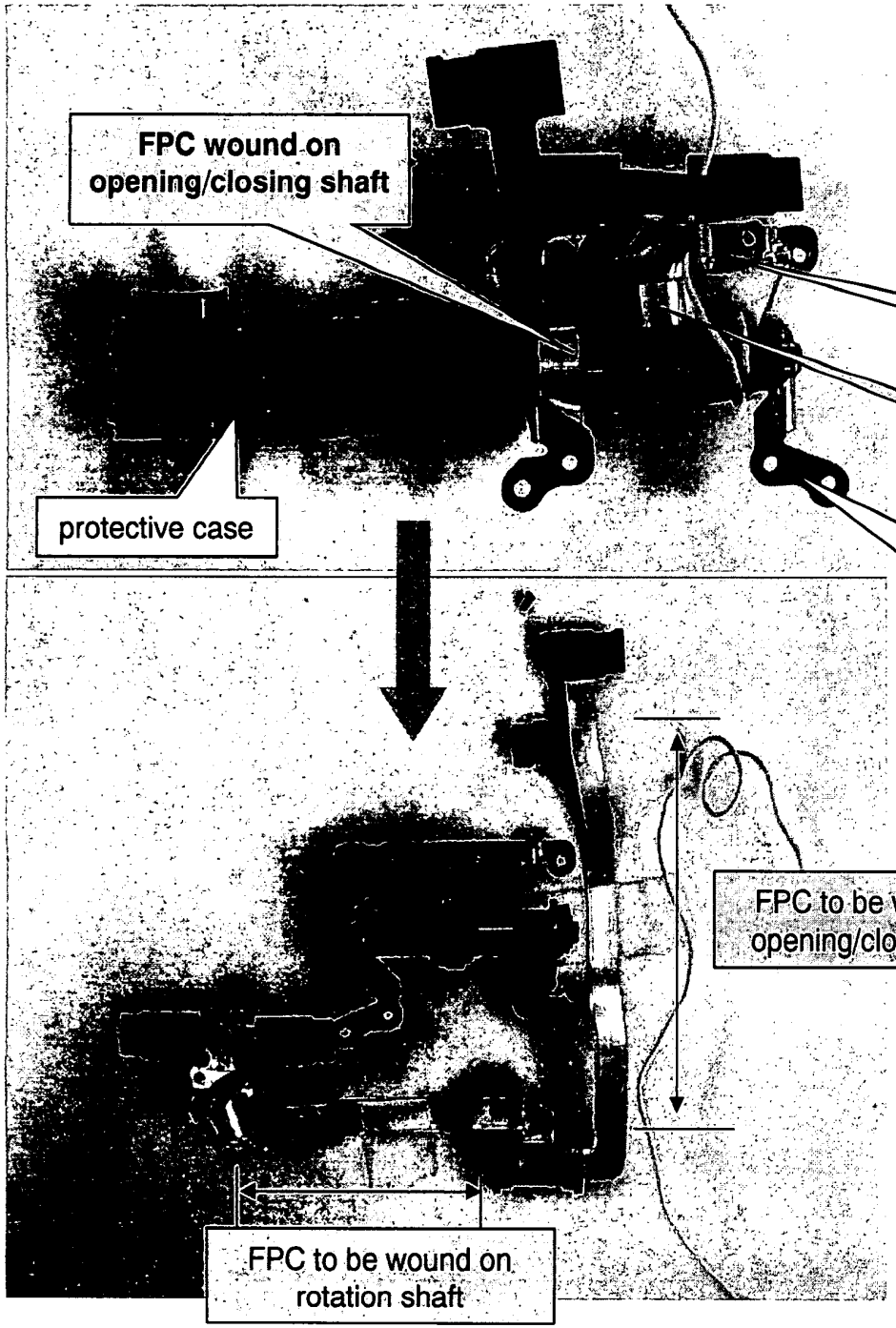
Fig. A1 Example for FPC wiring



The figures are for FPC and its wiring patterns used for DoCoMo's mobile phone, "FOMA" (Panasonic P2102)

FPC is shaped so winding to the shafts are easily worked.

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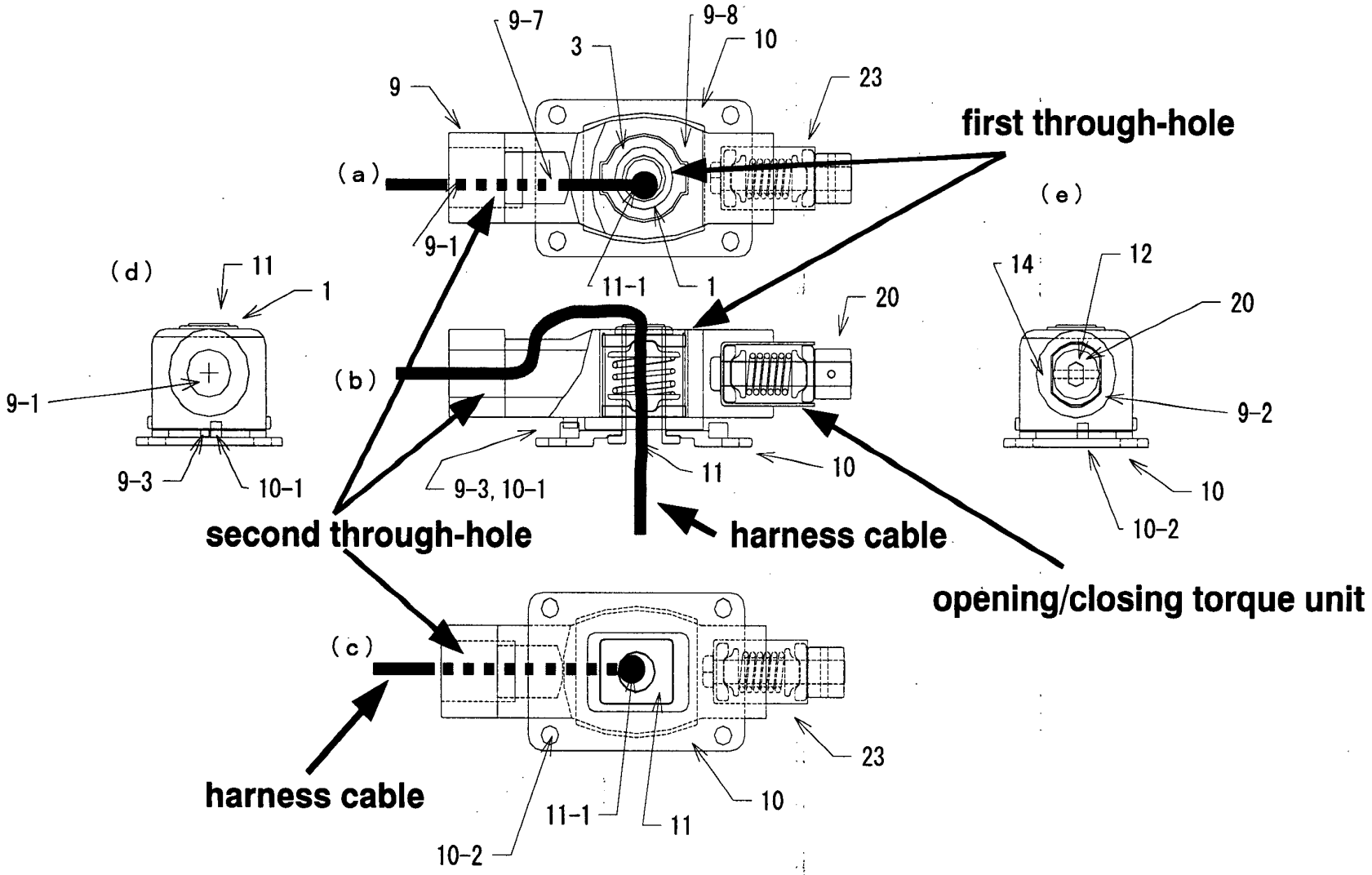


Fig. A2 Harness wiring of the present invention

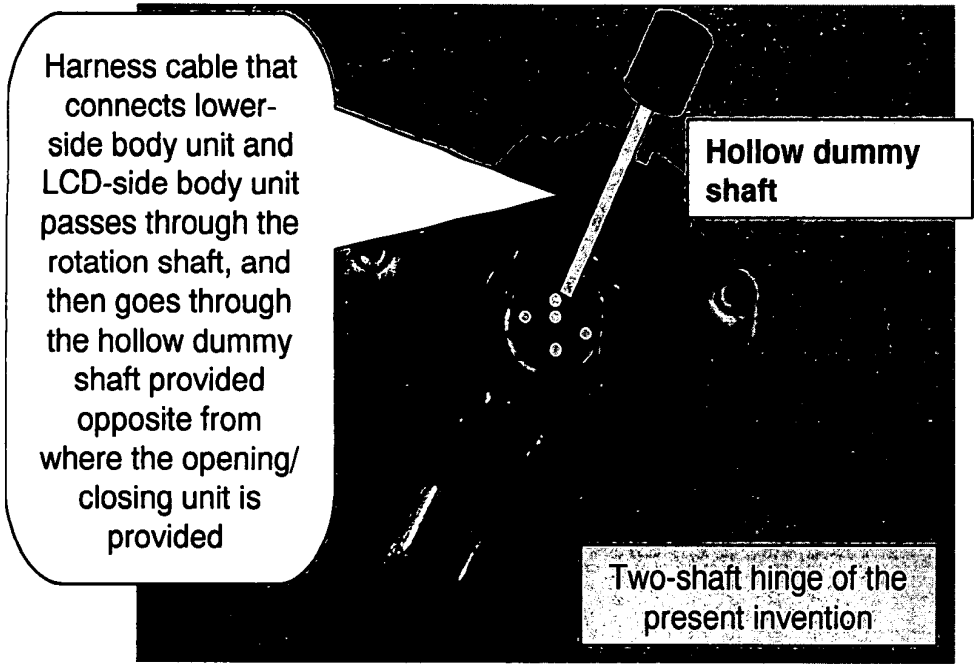
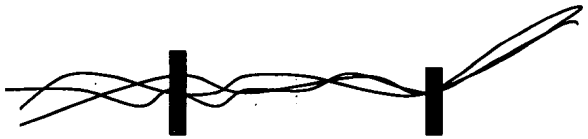


Fig. A3a Harness (cable bundle) wiring (present invention)



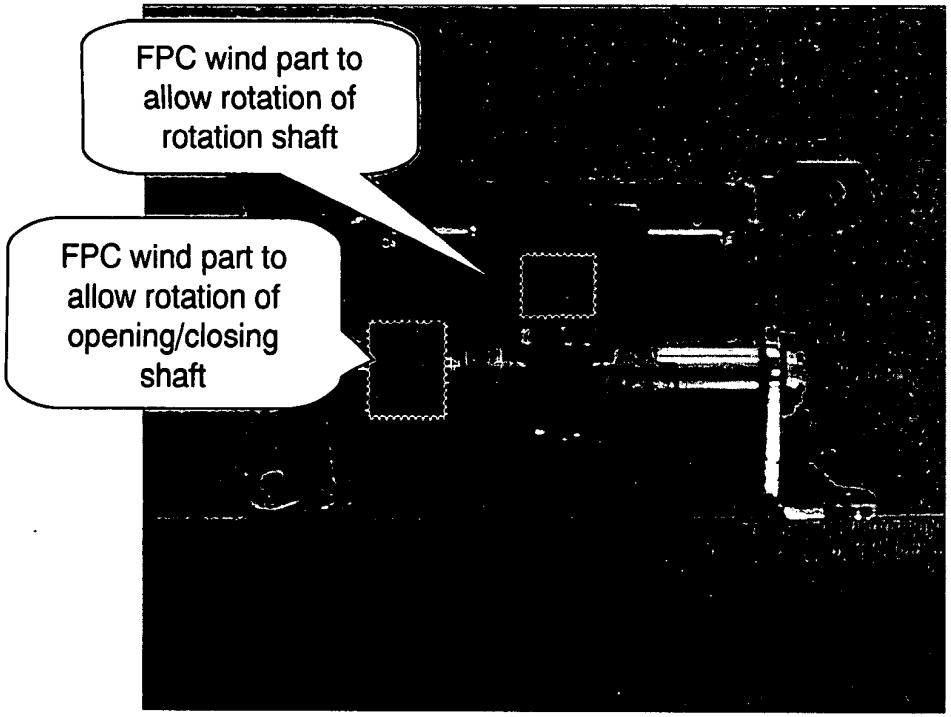


Fig. A3b Common FPC wiring

FPC is loosely wound on the shafts in order to make the shaft rotation possible as seen in the figure.

cross section view

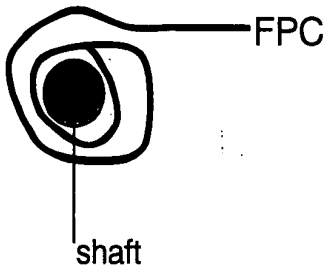


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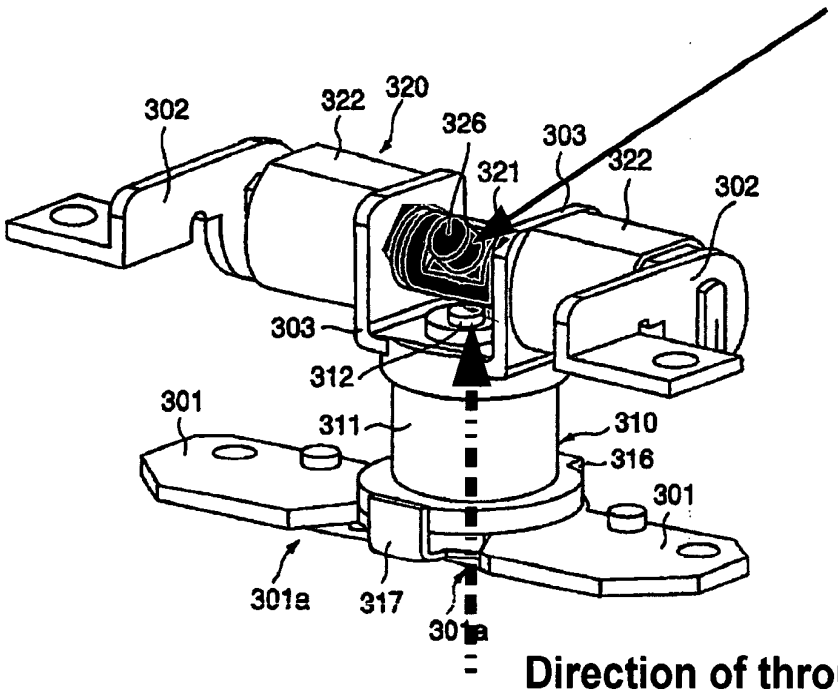
Fig. A4 Mizuta's hinge



The opening/closing shaft prevents continuous through-hole from the bottom to the top of the hinge even if one intends to make such a through-hole

Direction of through-hole

FIG. 5